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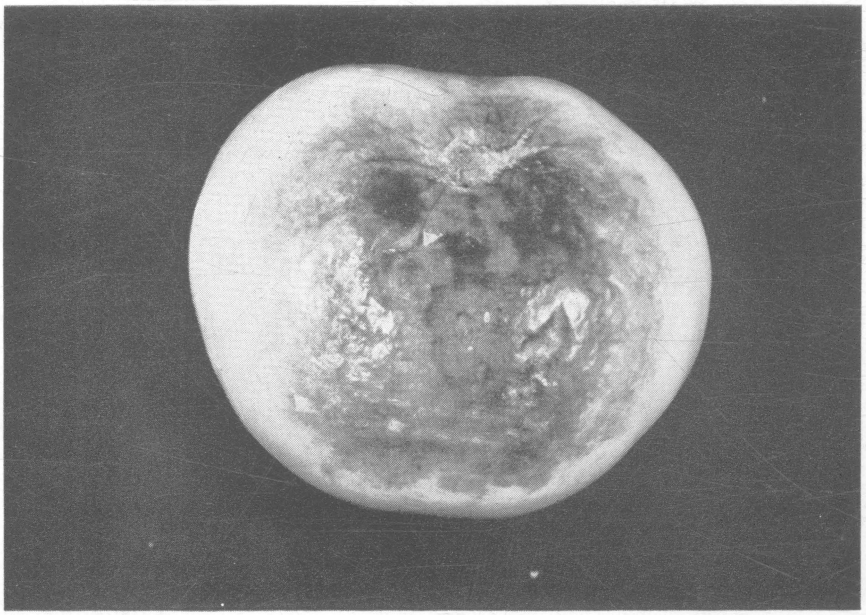

OHIO AGRICULTURAL EXPERIMENT STATION

Wooster, Ohio

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COMPARATIVE CONTROL OF FIVE FRUIT ROTS OF TOMATO BY VARIOUS FUNGICIDES

J. D. WILSON

INTRODUCTION

Tomato fruits are subject to several primary and secondary rots as they are grown in Ohio fields for the canning or processing trade. The five which occur most commonly and cause the greatest loss are,—late-blight fruit rot caused by ***Phytophthora infestans*** (Mont.) DeBy., early-blight fruit rot caused by ***Alternaria solani*** (Ell. and Martin) Jones and Grout, anthracnose fruit rot caused by ***Colletotrichum phomoides*** (Sacc.) Chester, buckeye rot ascribed to various species of ***Phytophthora***, and the so-called "soil rot" caused by ***Rhizoctonia solani*** Kühn.

Two of these diseases, late blight and early blight, commonly attack the foliage of tomato as well as the fruit. The other three seldom cause any appreciable defoliation of the tomato plants. Late blight rot can usually be found on the fruits whenever it is present on the foliage, and in some instances it is present on the fruit when it is difficult to locate any foliar lesions. Early blight, on the other hand, frequently causes severe defoliation of the tomato plant without causing any appreciable amount of fruit rot. Early blight appears on the foliage every year in most Ohio tomato fields, whereas late blight occurs much less frequently in commercial acreage.

Anthracnose causes more loss in processing tomatoes during the average year than any other of the diseases listed here. It forms only inconspicuous lesions on the leaf, whereas at the same time it frequently destroys from 10 to 20 percent of the fruits in unsprayed fields in Ohio. It is principally to control this disease that most growers spray their tomatoes, and thus the spray program and schedule is chiefly designed to control anthracnose. Buckeye rot is almost exclusively a fruit disease and occurs only sporadically, and then only in restricted, or localized areas in Ohio. The same is true of soil rot, and both are favored by flash rains that temporarily flood the surface of the soil. ***R. solani***, the causal organism of soil rot is universally present in Ohio soils that are used for the growing of vegetables, but is most likely to cause appreciable loss on tomato fruits only under conditions in which the fruits are in contact with wet or moist soil over a considerable period of time.

LATE BLIGHT

Late blight (see Figure 1) usually appears on tomatoes in at least a few gardens and/or fields each year in Ohio, although it has been very scarce on tomatoes during 4 of the past 5 years. It has caused widespread damage in at least 3 of the last 10 years (3, 4, 5) but in most seasons the total loss over the state is not large. The disease was responsible for a considerable amount of tuber rot on potatoes in Northeastern Ohio in 1956, but destroyed only a very few tomato fruits (9). Late blight can be controlled on tomato by a spray program in which an effective fungicide, of which there are several, is applied on a weekly schedule beginning about mid-July in central and northern Ohio and continuing until nearly the end of the harvest period if the disease is present or threatening (4).

This disease has not occurred in epidemic form on tomatoes in Ohio since 1950 and for that reason there has been no really good opportunity to check the comparative efficiency of various new fungicides to control it. However, in that year late-blight fruit rot was severe in four different experimental fields in the vicinity of the Experiment Station at Wooster where a considerable variety of fungicides

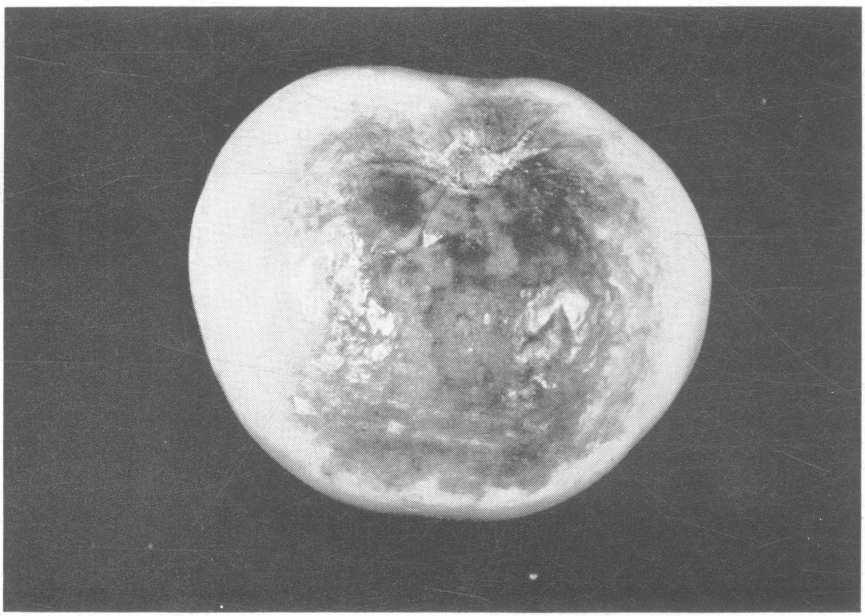

Fig. 1.—Late-blight lesion on a tomato fruit.

were being compared for the control of foliage diseases (4). This afforded an excellent opportunity to evaluate the materials under test at that time on the basis of their ability to control late blight fruit rot, and some of them are listed in Table 1, together with data on yield and foliage condition.

Ziram (Zerlate and Methasan) as usual gave comparatively poor control of late blight, both on the foliage and on the fruit. Methasan as a slurry did better than Zerlate as a wettable powder. Maneb (Manzate) and zineb (Parzate) gave considerably better control of the disease on fruit and foliage than did ziram, with maneb doing the better of the two. The fixed coppers (Tribasic and COC-S) gave the best control of rot on the fruit of the fungicides listed, but they did no better in controlling defoliation (due to both early and late blights) than did maneb and zineb. Captan was inferior to the coppers and the ethylene bis compounds, but was considerably better than ziram against late blight.

Thus, the data obtained in 1950 (averages of four different experiments in the vicinity of Wooster) indicate that the fixed coppers may be expected to give good control of late-blight fruit rot of tomato, and that the ethylene-bis dithiocarbamates (zinc and manganese) will do

TABLE 1.—Comparative control of late blight fruit rot on tomato by two fixed coppers, two ethylene-bis dithiocarbamates, two di-methyl dithiocarbamates, and captan. Data are average of four experiments in 1950

Fungicides	Formulas	Net yield Tons–acre	Culls Percent	Late blight fruit rot Percent	Foliage dead on Sept. 15 Percent
None		11.8	45.6	48.2	75
Tribasic	4 –100	25.0	8.3	1.9	33
COC-S	4 –100	24.0	10.4	2.8	35
Manzate	1.7–100	24.1	12.9	3.6	32
Parzate	2 –100	22.9	12.4	5.7	34
Captan	2 –100	23.5	14.8	8.0	44
Methasan	3 –100	19.0	20.9	11.0	35
Zerlate	2 –100	16.5	32.5	28.8	52
Average values for,—Tribasic & COC-S		24.5	9.4	2.4	34
Manzate & Parzate		23.5	12.7	4.7	33
Zerlate & Methasan		17.3	26.7	19.9	44

nearly as well. Captan (at 3 pounds per acre per application) is somewhat less effective than these four materials. The di-methyl compounds are still less dependable when late blight is present, with Methasan as a slurry capable of giving better control than will Zerlate as a wettable powder formulation.

EARLY BLIGHT

Early blight (see Figure 2) appears every year in Ohio fields and gardens, where it frequently causes medium to severe defoliation of unsprayed tomato plants. It sometimes attacks the fruits also, as it did at Wooster in 1956 (9). It is possible to control early blight on the foliage with a fair degree of success, even under weather conditions favorable for its development, by the use of various fungicides applied in a rather rigid spray schedule maintained throughout the summer from early July to mid-September (3, 5, 6, 7). The first application should be made even earlier in southern Ohio, and a plant-bed spray applied a few days before transplanting helps still further to protect the plants from this disease. One of the worst features of allowing foliar infection to become severe enough to cause noticeable defoliation is the

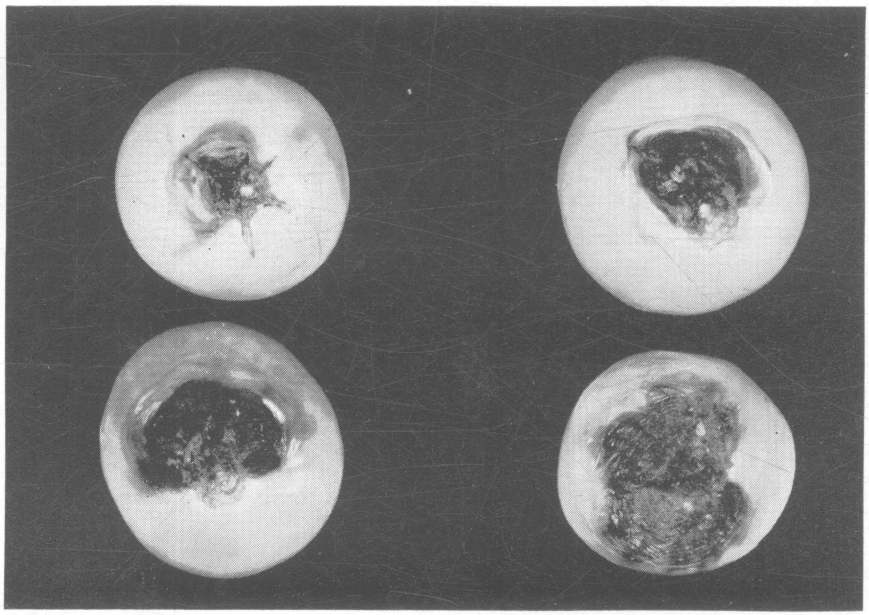

Fig. 2.—Early-blight lesions on the stem end of tomato fruits.

fact that the additional exposure of the fruits to bright sunlight during hot days in September makes them more susceptible than otherwise to infection by anthracnose.

As mentioned earlier, the disease sometimes attacks the fruit, where it causes a hard, black lesion, usually at the stem end. The fruit may be attacked (infected) directly through a break in the epidermis, but more commonly the sepals are infected first, after which the fungus grows into the stem, or pedicle, and from there into the fruit itself, where it causes the type of lesions shown in Figure 2. Quite often the union between the pedicle and the fruit is so weakened that the fruits drop off the plant.

Early blight became very severe on tomatoes in the vicinity of Wooster in 1956, and as one result of this a considerable percentage of the fruits on unsprayed plants, as well as those in plots sprayed with fungicides that gave poor control of the disease, became infected (9). The loss of fruit was appreciable in three different experiments and some of the data relative to these are given in Table 2. In one series of plots in which various fungicide formulations were being compared for the control of whatever foliage and fruit diseases might occur during the season, 6 percent of the fruits in the unsprayed check plots contracted the disease (first data column in Table 2). In this instance it was best controlled by maneb (80 percent centrol), with ziram ranking second. An antibiotic (Griseofulvin), which it was thought might give some control of Alternaria, ranked second with captan and zineb in fourth and fifth places, respectively. This low ranking of zineb (Dithane Z-78) was somewhat surprising, since this material usually gives very good control of early blight on the foliage (3, 6).

In another experiment in which several variations in Zerlate formulations were being compared (second data column of Table 2) nearly one-fourth of the unsprayed fruits showed early-blight lesions. In this instance maneb (Manzate) again gave good control, with Tribasic giving similar results. Zerlate used alone at 3 pounds per acre per application gave only about 50 percent control, which corresponds roughly to its usual performance against this disease (6). When Zerlate and Tribasic were applied in a tank-mix formulation the control was slightly improved, and replacing half of the Zerlate with Manzate (tank-mix) gave still better results.

In the third experiment (3rd data column of Table 2) several old and new fungicides were being compared. Early blight destroyed 8 percent of the unsprayed fruits in this test. Maneb (Manzate) again did as well as any other fungicide, being tied with Dyrene for first place.

Two other experimental compounds (Omadine Zn and Phaltan) also gave very good control of early blight fruit rot in this experiment. Captan was in fifth place with about 60 percent control, with Zerlate, Cop-O-Zinc and Tribasic giving lesser degrees of control.

Thus, in considering the data of Table 2 as a whole, maneb as Manzate gave the best control of early blight fruit rot, with ziram as Zerlate giving comparatively poor results. This is about what one would expect on the basis of results obtained in numerous experiments on the control of the same disease on the foliage. Zineb as Dithane Z-78 should have given better control of the fruit rot than it did in one experiment, since it has slightly out-performed maneb in an average of several years results on staked tomatoes at Marietta (6). Two or three experimental fungicides looked very good against early blight in a single test, as they did in controlling anthracnose fruit rot (9).

ANTHRACNOSE

Anthracnose fruit rot is one of the most serious diseases to which Ohio tomatoes are subjected (see Figure 3), especially in the processing crop area. The percentage of diseased fruits varies from harvest to

TABLE 2.—Control of early-blight fruit rot on tomato by various fungicides in three different experiments at Wooster in 1956

Fungicides	Formulas	Percentage of diseased fruits in experiments dealing with,—		
		Formulations	Zerlate variations	Old and new fungicides
None		6.0	22.8	8.3
Manzate	2–100	1.2	4.6	1.8
Zerlate	2–100	2.1	11.5	4.7
Captan (50-W)	3–100	3.1		3.3
Dithane Z-78	2–100	4.6		
Griseofulvin	100 p.p.m.	2.4		
Tribasic	4–100		4.6	6.2
Zerlate + Tribasic + Milk	1–2–½–100		9.0	
Zerlate + Manzate	1–1–100		6.1	
Omadine Zn	1½–100			2.4
Dyrene	3–100			1.8
Phaltan	2½–100			2.7
Cop-O-Zinc	4–100			5.0

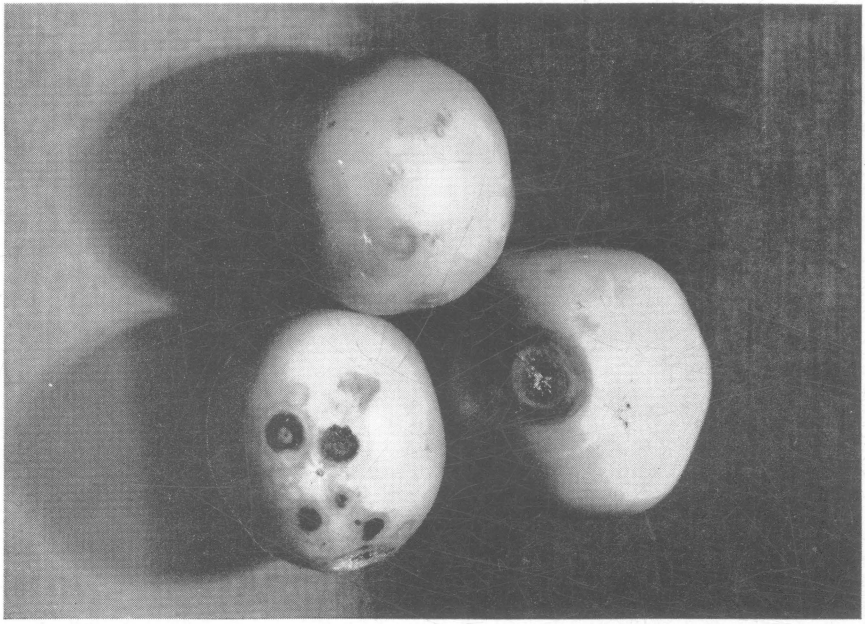

Fig. 3.—Anthracnose lesions in different stages of development on tomato fruits.

harvest during the season and is regulated by numerous factors, the exact role of most of which is not too well understood. The loss caused by the disease also varies from season to season, depending upon the intensity of various weather factors such as rainfall, temperature, sunlight, etc. In a given field the extent to which the disease develops is regulated by soil type, previous cropping history, the variety of tomato being grown, the general nutritional level, and the extent to which the plants may be defoliated by other diseases, such as early blight. Fruits on plants with sparse foliage are usually more subject to infection than are those that are well protected from sunburn by a good leaf cover. Thus, anything that aids in the development and maintenance of a good foliage cover, such as a sufficiently high nitrogen level in late August and September, and a spray program capable of controlling foliage diseases, will help to lower the disease level, even though it does not in itself prevent infection. In view of this, the best insurance against loss from anthracnose is the application, at 7 to 10-day intervals, of a fungicide capable of controlling foliage diseases, as well as anthracnose itself (3, 4, 5, 6, 7).

The selection of a fungicide for this purpose has not been as simple as it might seem. For instance, a fixed copper such as Tribasic or COC-S that might give good control of late blight (4) is comparatively ineffective against anthracnose. On the other hand, ziram (Zerlate and Coro SDD + $ZnSO_4$) which is capable of giving very good control of anthracnose fruit rot gives very poor control of late blight (4), and is not too good against early blight. Zineb (Dithane Z-78 and Parzate), is very effective against both early and late blights, but leaves something to be desired in the control of anthracnose. At the present stage of fungicide development maneb (Manzate and Dithane M-22) seems to most closely fit the control specifications. This material not only gives good anthracnose control, but gives a creditable performance against most, if not all, of the foliage diseases of tomato (7). To further test the capabilities of these, as well as a few materials of more recent vintage, an attempt will be made to evaluate them further on the basis of data obtained in 1956, the most pertinent of which are presented in Table 3.

Data on anthracnose control was obtained in at least eight experiments in 1956, and those relative to seven of them are presented in Table 3, six of these trials being at or near Wooster and one at Marietta. The data in the first column on the left in Table 1 are the averages of two experiments on anthracnose control (one irrigated and one not). In these experiments maneb (as Manzate) gave the best control, followed not too closely by a half and half mixture of maneb and ziram. Ziram (Zerlate) alone did slightly less well, and captan ranked still lower. Griseofulvin gave very little control in this instance and ranked lowest in two other experiments in which it was included. This would seem to rule out this antibiotic as a fungicide for use against anthracnose.

In a comparison of the copper, zinc and manganese forms of the ethylene bis dithiocarbamates the sulfates of each were added to nabam (Dithane D-14) and the tank-mix formulations were then applied to tomatoes in three different experiments. In each instance the copper salt gave the best control of anthracnose, with the zinc salt ranking second, and the manganese compound did least well. Also, in all three instances the tank-mix formulation of maneb was considerably less effective than the wettable powder.

TABLE 3.—Comparative control of anthracnose fruit rot of tomato by various fungicidal materials in several different types of experiments in Ohio in 1956

Fungicides	Formulas	Percentages of anthracnose in experiments dealing with,—					
		Anthracnose control at Wooster*	Control of buckeye rot	Influence of timing	Zerlate variations	Anthracnose control at Marietta	New and old fungicides
None	————	18.3	27.9	9.1	5.3	16.8	12.8
Maneb	2–100	5.4	5.0	0.7	1.6	0.4	0.6
Ziram	2–100	8.7	8.7	1.2	1.5	1.8	1.1
Ziram + maneb	1–1–100	8.4			1.8	0.5	
Ziram + Tribasic	1–2–100	10.8			2.3	2.6	
Tribasic	4–100		13.0	1.1	3.1		2.8
Captan	3–100	9.4	7.3			4.3	2.4
Dyrene	3–100		3.8				0.9
Phaltan	2½–100						0.7
Cr-2754	2½–100		7.7				1.2
Nabam + $CuSO_4$	4–1–100	9.7					1.2
Nabam + $ZnSO_4$	4–1–100	11.1					2.3
Nabam + $MnSO_4$	4–1–100	13.3					3.7
Griseofulvin	100 p.p.m.	17.7		3.9		6.5	

*Data are averages of two nearly identical experiments.

Dyrene was one of the newer fungicides tested against anthracnose in 1956 and it gave a very good account of itself in the two experiments in which it was used, ranking first in one and third in the other. In the second experiment listed in Table 3 (buckeye rot control) Dyrene gave somewhat better control of anthracnose than did maneb, and in the comparative test of old and new fungicides (last column of Table 3) it was only slightly less effective than maneb and another new fungicide designated as Phaltan. Thus, Dyrene would seem to be worthy of a further test in the control of tomato anthracnose.

Phaltan, which is an analogue of captan, did somewhat better than did captan in the experiment in which the two were compared, ranking only slightly below maneb in control efficiency against anthracnose. This material too should be tested further.

Ziram failed to match maneb in performance in every one of the six listings in Table 5, the former showing an average control of 70 percent compared to 82 percent for the latter. When half of the ziram was replaced with maneb an average control of 65 percent for ziram alone was increased to 68 percent for the mixture. A tank-mix formulation of ziram (Zerlate) and Tribasic did less well than ziram alone, with the latter giving a control percentage of 65 percent, whereas the mixture dropped to 55 percent.

Thus, maneb again gave the best overall control of anthracnose fruit rot of tomato in 1956. Ziram, which did less well, was improved slightly by the addition of maneb, and rendered less effective by the addition of Tribasic. Captan was less effective than maneb in a total of five experiments (65 and 82 percent control, respectively) and slightly less so than ziram with control percentages for the two of 65 and 70, respectively. Copper carbamate in a tank-mix formulation gave slightly better control than either the zinc or manganese compounds, and the tank-mix formulation of maneb ranked well below the wettable powder in control effectiveness. Two newly introduced fungicides, Dyrene and Phaltan, appear to be possible rivals of maneb in the control of tomato anthracnose. Finally, an antibiotic known as Griseofulvin failed by a wide margin to equal materials such as maneb and ziram in the control of anthracnose.

BUCKEYE

Buckeye rot of tomato, which is caused by a fungus closely related to the causal organism of late blight, is of considerably less importance to Ohio growers than any of the three diseases previously discussed. It occurs only occasionally and then only under a very special combination of environmental conditions (flooding of the soil and/or splashing of muddy water over the fruits), and even then the disease may persist for only a short period during the harvest season. However, it did cause a very appreciable loss in one experimental tomato planting at Wooster in 1955, and this provided an unusual opportunity to compare the performance of several fungicides in its control (8). The disease usually causes a large, somewhat zonated, and blotchy, dark-colored lesion on the surface of the fruit (see Figure 4). It may attack any time after the fruit is set and until mature, and renders it entirely unfit for use.

Certain fixed coppers (COC-S and Tribasic) had been previously reported to give very good control of the disease in Tennessee (2), but unfortunately neither of these were included as the sole treatment on any of the plots in this experiment, which had originally been designed

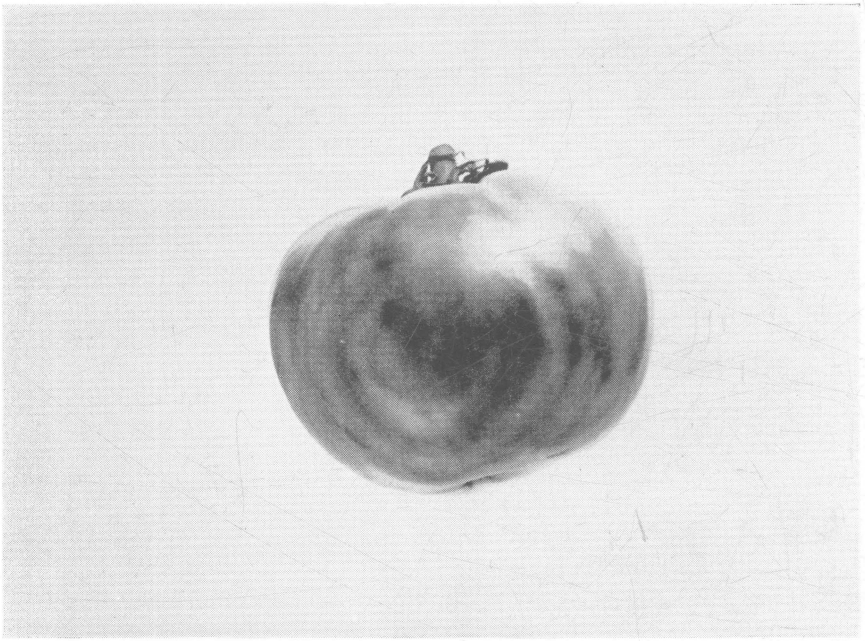

Fig. 4.—Buckeye rot covering the whole side of a tomato fruit. Note zonations. Courtesy Dr. S. P. Doolittle, U. S. Dept. Agriculture, Beltsville, Maryland.

to study the control of anthracnose, a disease which is not subject to control by this group (the fixed coppers) of fungicides. Instead, most of the treatments being compared were known to be capable of giving at least a fair degree of anthracnose control. Eight of these formulations are listed in Table 4, the data of which show the percentage of infected fruits in the differently treated plots, together with the degree of control when the amount of disease in the untreated check plots was considered as 100.

Captan gave by far the best control of buckeye rot in this experiment, this being one instance (and one disease) in which maneb had to take second place. It is interesting to note that Tribasic (a fungicide which had given good results in another state) did improve the performance of the two dithiocarbamates (ziram and maneb) with which it was formulated. It improved the comparatively effective maneb much less than the less active ziram (Treatments No. 2 and 4 versus No. 5 and 6). The tank-mix formulation of ziram (Treatment No. 7) was somewhat more effective than the wettable powder (Treatment No. 5), although neither gave a satisfactory degree of control. On the

TABLE 4.—Control of buckeye rot of tomato by various fungicides and fungicidal formulations at Wooster in 1955. Data are averages on twelve varieties

Treatments	Formulas	Percentage of fruits diseased	Percent control
1. None	———	31.3	0.0
2. Dithane M-22	2–100	10.4	56.3
3. No. 2 + Zerlate	1–1–100	13.4	42.4
4. No. 2 + Tribasic	1–2–100	9.3	61.7
5. Zerlate	2–100	19.6	22.5
6. No. 5 + Tribasic	1–2–100	10.0	57.7
7. SDD + $ZnSO_4$	2–1–100	14.3	50.0
8. Dithane D-14 + $MnSO_4$	4–1–100	25.6	18.8
9. Captan 50-W	3–100	3.3	85.5

other hand, the tank-mix formulation of maneb (Treatment No. 8) did very poorly in comparison with the wettable powder (Treatment No. 2). Thus, this was an instance in which a fungicide (captan), which gave only an average degree of control of the other four diseases discussed here, proved to be somewhat specific for the control of another. However, it is seldom that captan would be recommended as a tomato fungicide to the exclusion of various others listed here, since this particular disease occurs so infrequently in Ohio.

RHIZOCTONIA

Rhizoctonia, or soil rot, of tomato fruits seldom causes any appreciable loss of production in Ohio but it may destroy as much as 5, or more, percent of the fruits in individual fields or gardens during any season. However, its presence may pass unnoticed as just another fruit rot by anyone not searching for it. The lesions indicative of the disease are often quite striking in their size and zonation patterns (see Figure 5). This disease, like anthracnose and buckeye rots, and unlike early and late blights, does not defoliate the plant. Its control is seldom, if ever, considered in designing a spray program for the control of the foliage and fruit diseases of tomato in Ohio. It did appear in three different experiments at Wooster in which various fungicides were being compared for the control of anthracnose and buckeye fruit rots, and counts were made on its occurrence in the differently treated plots as the fruits were being examined (graded) for the presence of those two diseases (anthracnose and buckeye). Some of the data obtained are presented in Table 5.

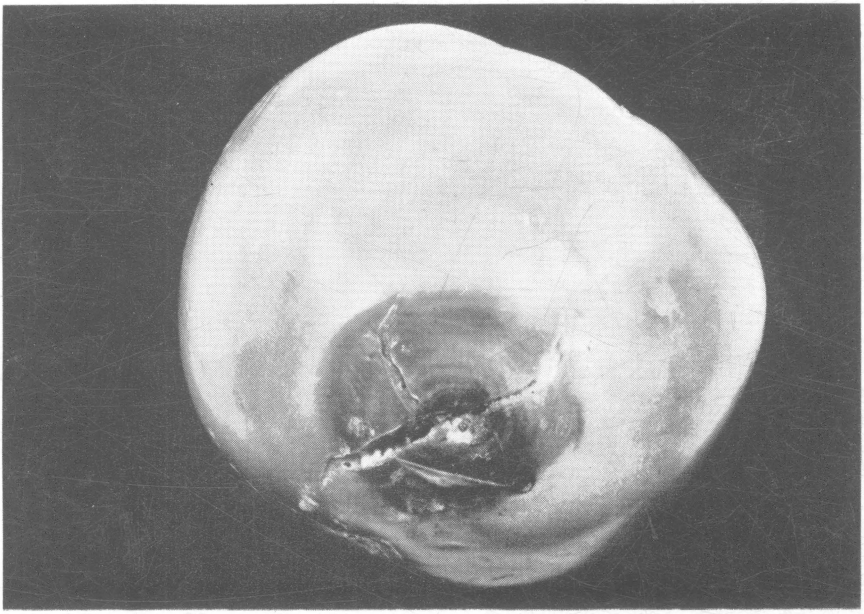

Fig. 5.—Rhizoctonia (soil rot) lesion on tomato fruit.

In the first experiment listed in Table 5 the tank-mix formulation of maneb (nabam + $MnSO_4$) gave the best control (nearly 40 percent of soil-rot) whereas several of the fungicides gave no more than a 10 percent reduction in the disease. In the non-irrigated duplicate of the first experiment, tank-mix maneb was again best, with a 60 percent reduction in rot, and Manzate (the wettable powder) was second best. Griseofulvin (an antibiotic) gave some control, but hardly enough to justify its use. It is interesting to note that the plots sprayed with captan actually showed more Rhizoctonia rot than was present in the unsprayed checks in two different experiments.

In the third experiment there was comparatively little control by any of the fungicides. Dyrene gave the greatest reduction in fruit rot, and zineb gave no control.

Thus, an analysis of the data as a whole indicates that none of the fungicides listed in the three experiments gave any appreciable, or worthwhile, control of Rhizoctonia fruit rot and one might assume that the disease would be very difficult to control whenever environmental conditions become favorable for fruit infection. Maneb as a tank-mix formulation gave the best control, doing better than the wettable powder against this disease, but with no material giving more than

TABLE 5.—Comparative control of Rhizoctonia fruit rot of tomato by various fungicides at Wooster in 1956

Treatments	Formulas	Percentage of fruits with Rhizoctonia in,—		
		Irrigated anthracnose experiment	Non-irrigated anthracnose experiment	Buckeye rot experiment
Maneb (Manzate)	2–100	4.2	3.0	4.1
None	———	4.6	7.6	4.6
Zineb (Parzate)	2–100			5.7
Ziram (Zerlate)	2–100	4.2	3.1	4.2
Captan 50-W	3–100	6.0	8.3	3.2
Dyrene	3–100			3.1
Cr 2754	2½–100			3.7
Tribasic	4–100			4.0
Nabam + $CuSO_4$	4–1–100	3.2	5.8	
Nabam + $ZnSO_4$	4–1–100	4.2	3.1	
Nabam + $MnSO_4$	4–1–100	2.5	2.7	
Griseofulvin	100 p.p.m.	4.0	3.5	

about 50 percent control. With the disease being no more important than it is during most seasons, it would seem that no specific control recommendation need be made.

SUMMARY

Fruit rots frequently take 10 to 25 percent of the tomato crop in Ohio, and the loss may run much higher if no effort is made to control them.

Fifteen years ago when a comparatively small percentage of the tomato acreage was sprayed for disease control many plantings did not exceed 5 or 6 tons per acre of salable fruit with a yield of 15 tons being unusual, and losses from rots and sunburn frequently equalled 50 percent of the total potential production.

Today when virtually all of the processing acreage is sprayed the average yields are consistently exceeding 10 tons per acre, with numerous fields producing over 20 tons of salable fruit.

There are several fruit rots that cause appreciable loss in Ohio tomato fields, the most important of which are late-blight, early-blight, anthracnose, buckeye and Rhizoctonia.

Of these, anthracnose occurs most frequently and causes the greatest loss, late blight occurs much less frequently but can cause severe loss in an epidemic year; whereas early-blight, buckeye, and Rhizoctonia rots cause appreciable loss only in isolated instances, but may be responsible for a 5 to 10 percent loss in some fields.

Three of these rots caused considerable loss in certain experimental plots near Wooster in 1956, buckeye rot was severe in one experiment in 1955, and late blight was very destructive in 1950. These data have been utilized to compare the disease-control effectiveness of various fungicides that were under test in each instance where a specific disease occurred.

Two fixed coppers (Tribasic and COC-S) gave the best control of late-blight fruit rot in 1950. These were followed in effectiveness by two ethylene-bic dithiocarbamates (Manzate and Dithane Z-78), and two di-methyl compounds (Zerlate and Methasan) gave the poorest results.

Early blight fruit rot was best controlled in three different experiments in 1956 by maneb (Manzate). One experimental compound (Dyrene) gave nearly as much control as maneb, but ziram (Zerlate) and a fixed copper (Tribasic) gave only mediocre results.

Maneb gave the best control of anthracnose in 6 out of eight experiments in 1956 and ranked second in the other two. In one of these Dyrene gave slightly better results than maneb and in the other ziram (Zerlate) was the better by a very narrow margin. Ziram, which is considered to be more effective against anthracnose than most fungicides, was first in only one experiment, and ranked from second on down to fourth in others of the eight experiments. Two newcomers in the field of vegetable fungicides (Dyrene and Phaltan) gave good control of this disease in experiments where they were used.

Captan gave the best control of an outbreak of buckeye rot in one experiment in 1955. Maneb ranked second, with ziram giving poor results. The fixed coppers, which are sometimes recommended for the control of this disease, were not applied except in combination with maneb and with ziram, where Tribasic improved the performance of both of the dithiocarbamates.

Rhizoctonia, or soil-rot, was not very well controlled by any one of several fungicides. Maneb did as well as any of those being compared in various experiments, and captan gave no control of the disease.

Thus, the data presented here in connection with the control of five different fruit rots of tomato indicate that no one fungicide is best for the control of all of them. Maneb did rank first against early-blight, anthracnose and Rhizoctonia rots, but had to yield to certain fixed coppers in the control of late blight on both the foliage and fruit, and to captan in the control of buckeye rot.

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